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ABSTRACT

The study explored methods and techniques for training mentally retarded adults to perform gardening tasks. A total of 31 subjects ages 21 to 48 (IQ range 32-89) participated in the study, which consisted of three phases. In an initial pilot study, experimentation without subjects resulted in the development of modified tools (e.g., notched yardsticks for spacing seeds and color-coded hoes with steel guards). During the second pilot study, subjects were taught to use the tools. Based on problems encountered, additional modifications were made, including the use of an earth puncher instead of a hoe for brain-injured subjects. The third study added a greenhouse operation and evaluated subjects' performance over a 10-week period on 21 separate gardening tasks (e.g., preparing potting soil, using tiller, planting seeds with spacer, and covering seeds in seed bed). Techniques of physical assistance, demonstration, verbal direction, prompting, and fading were used in instruction. Results indicated that a total of 17 tasks could be mastered by subjects with an IQ as low as 32. Subjects were found to work more productively in their own individual gardens than in a large community garden. (Author/JW)

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VOCATIONAL HORTICULTURE FOR PERSONS WITH MENTAL RETARDATION.

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ABSTRACT

This study attempted to discover ways to train thirty-one mentally retarded subjects to perform work in a garden and in a greenhouse. The first pilot study was carried out by two staff members to determine techniques to train mentally retarded subject. The second pilot study was carried out with low moderate to severely retarded subjects and modified tools were produced, including special tools for brain injured subjects. The main study was carried out with higher level subjects (up to 89 I.Q.) as well as the original lower level subjects. A moderate correlation was found between learning proficiency and I.Q., Subjects with I.Q.s from 32 upward mastered several horticulture tasks (gardening and/or greenhouse). Subjects work better in their own individual garden than in a large community garden.

The use of horticulture as s training program for the mentally retarded individuals has recently gained importance. Studies have considered horticulture (1) therapy (2) leisure time activity (3) pre-vocational education and (4) vocational training.

Hefley, (1973) gave a brief historical review of the use of gardening as a therapeutic tool, having been used as a curative of ills of the mind before psychiatry became a science.

Chandler (1977) reported positive effects upon a class of moderately retarded (trainable) students, 12 to 17 years of age with mental ages 3 to 7 years, as a result of a "Babysitting for Houseplants Program". Olowzony (1978) published a book in which programs were outlined for disabled people of all types. Relf (1981) published a book about the dynamics of Horticulture Therapy.

McCarron, Kern and Wolf (1979) explored the use of horticulture as a leisure time activity for mentally handicapped individuals whose intellectual capacity ranged from borderline to severe mental retardation. The results suggested that gardening as a vocation for mild, moderate and severely retarded may be a possibility.

Relf, McDaniel and Chaves (1982) suggested the use of horticulture for prevocational training for EMR (mildly retarded) students.

Vocational Horticulture is becoming more recognized in the literature. Miller and Wood (1970) described an experimental program for mentally handicapped students in a secondary program in Vancouver, Washington to teach use of basic tools, acquaint them with area of work, promote preliminary vocational skills and help parents understand the possibility of horticultural vocations.

Melwood Horticultural Training Center, Inc. is an outstanding facility in the area of training handicapped adults (over 21 years of age) in horticulture. It has existed since 1963 and is a private non-profit organization. Both men and women are trained. The program has been very successful. More than 200 graduates are employed in the community with an average annual worker's salary of $10,740.00. Hourly wages range from $4.78 to $6.50. The jobs include commercial grounds maintenance and landscaping contracts throughout the Washington, D. C. area, as well as greenhouse and gardening work.

The above studies offer interesting philosophy and suggestions for setting up a horticultural program. However, no hard data are given in any of the above studies. Can all of the students master all of the tasks? Probably not. What level of intelligence is needed to perform specific tasks? What is the critical cut off in intelligence for each task? The present study attempts to answer these problems.

METHOD

Subjects

Adult subjects who participated in this phase, included severely, moderately and mildly retarded individuals.

A total of thirty-one (31) subjects were in the study. Originally thirty-four (34) subjects were in the project but three had to be dropped because of lack of testing. There were twenty (20) males and eleven (11) females. All were adults ranging in age from 21 years to 48 years. The I.Q. range was from 32 through 89 (See Table I). One subject was blind and mentally retarded and one subject was deaf and

TABLE I

Subjects in Study, Giving Sex, Age and I.Q. Scores

Client No.	Sex	Age	Scores
1	M	32	WAIS VIQ 56, PIQ 47, FSIQ 49
2	M	21	WAIS VIQ 64, PIQ 62, FSIQ 61
3	M	25	S.B. M.A. 5 yrs. 0 mo. I.Q. 32
4	F	22	WAIS VIQ 57, PIQ 54, FSIQ 53
5	F	28	WAIS VIQ 48, PIQ 50, FSIQ 46
6	F	29	S.B. M.A. 5 yrs. 6 mo. I.Q. 34
7	M	48	WAIS VIQ 58, PIQ 48, FSIQ 51
8	M	22	WAIS VIQ 57, PIQ 51, FSIQ 52
9	F	29	WAIS VIQ 55, PIQ 59, FSIQ 54
10	F	22	WAIS VIQ 61, PIQ 60, FSIQ 59
11	F	27	WAIS IQ 49
12	F	23	S.B. M.A. 4 yrs. 2 mo. I.Q. 34
13	M	29	S.B. M.A. 4 yrs. 4 mo. I.Q. 32
14	M	27	WAIS VIQ 64, PIQ 51, FSIQ 56
15	F	42	WAIS VIQ 74, PIQ 76, FSIQ 73
16	F	31	WAIS VIQ 54, PIQ 52, FSIQ 50
17	M	47	WAIS VIQ 90, PIQ 89, FSIQ 89
18	M	43	WAIS VIQ 82, PIQ 87, FSIQ 83
19	M	25	WAIS VIQ 58, PIQ 68, FSIQ 60
20	F	30	WAIS VIQ 63, PIQ 65, FSIQ 62
21	M	21	WAIS VIQ 55, PIQ 48, FSIQ 50
22	M	41	WAIS VIQ 57, PIQ 59, FSIQ 56
23	M	49	WAIS VIQ 59, PIQ 84, FSIQ 68
24	M	26	WAIS VIQ 55, PIQ 48, FSIQ 49
25	M	38	WAIS VIQ 63, PIQ 67, FSIQ 63
26	F	34	WAIS VIQ 64, PIQ 44, FSIQ 53
27	M	24	WAIS VIQ 81, PIQ 70, FSIQ 75
28	M	28	WAIS VIQ 67, PIQ 65, FSIQ 64
29	M	20	WAIS VIQ 80, PIQ 73, FSIQ 75
30	M	23	WAIS VIQ 42, PIQ 51, FSIQ 43
31	M	21	WAIS VIQ 66, PIQ 68, FSIQ 65

mentally retarded.

Several of the subjects with lower I.Q.s had brain damage and three of them had cerebral palsy.

Tests Used

All subjects were tested on either the Stanford-Binet Intelligence Scale, Form L-M or The Wechsler Adult Intelligence Scale. The full scale I.Q. was used in all calculations (below).

All subjects were tested on the McCarron-Dial Work Evaluation System (MDWES). A separate report of relationships between this battery of tests and proficiency in learning gardening tasks is reported in another publication: McCarron, Kern and Wolf - (1979) "Gardening: Leisure Time Activities for the Mentally Retarded".

PROCEDURE

First Pilot Study

The first pilot study, financed by the Fannie Blumberg Special Education Endownment Fund, was carried out by the senior author and a professional horticulturist, on a piece of farm land. No mentally retarded subjects were present and the purpose was to experiment with methods of teaching the mentally retarded to plant and tend the plants.

A total of sixteen different crops were planted. They were sweet potatoes, cucumbers, tomatoes, bell peppers, banana peppers, pole beans, onions, red beets, carrots, turnips, lima beans, green beans, black-eyed peas, okra, sweet corn and potatoes.

In all phases of summer work, attempts were made to determine methods to teach the activities to mentally retarded subjects. Teaching aids for planting and methods of teaching the activities were developed, as described below.

The first problem was to determine a method for teaching the mentally retarded to properly space the seeds for different types of plants. Instructing the mentally retarded subjects to place the seed 4" apart would be meaningless. It was found that plants fell into seven different types in regard to the distance required between plants from radishes and peas (1" -2" apart) to pole beans and tomatoes (36" apart).

An ordinary yardstick was used for a measure. For plants that must be placed 36" apart the entire yardstick would be used. For plants which must be placed 4" apart, a notch was to be carved out in a yardstick every 4" and the subject was to be taught to place a seed at each notch. It would be necessary for the supervisor to be sure that the subject had the yardstick which was appropriate to the distance required by the plant.

The next problem was to create a method of teaching the mentally retarded subjects to plant each seed at the proper depth. It was observed that almost all plants which were used should be planted at one of three possible depths: ½", 1", 2".

It was decided to use three different hoes and color code them. For example, a green hoe was to be marked at the metal end so that when the hoe was dug into the soil up to the line, a trench of exactly ½" would be made. Likewise, when a yellow hoe was used, a trench of exactly 1" would be made. A red hoe was used for a trench of 2".

The seeds arrived in brown bags. By using color coding, the seeds

which required a depth of only ½", were placed in bags marked, by crayon, with a large green spot. Likewise, seeds requiring a depth of 1" were placed in bags marked with a yellow spot and seeds requiring a depth of 2" were placed in bags with a red spot. It would be necessary for the supervisor to be sure that the color on the bag of seeds matched the color of the hoe and that the subject dug the hoe into the soil up to the line.

During the summer the garden was cultivated and fertilized. The plants were dusted to guard against insect pests and diseases and weeks were pulled.

Second Pilot Study

Creation of Special Tools

During the first pilot study the concept of using color coding was suggested as well as the use of a spacer which was a yardstick with notches cut into it at 1", 2", 4", etc. This procedure worked very well with most of the mentally handicapped subjects. (See Plate I)

The bags from which the seed came were colored with the appropriately colored crayon.

The hoes were modified with a steel guard, i.e. a 1" depth for the green hoe, a 1¼" for the yellow hoe and a 2" depth for the red hoe. The subjects would, therefore, be instructed to merely drive the blade of the hoe as deeply into the ground as they could, which would be at the level of the guard. This worked very well for most subjects. The first week was spent in the small "orientation" garden where the subjects were drilled on use of the hoes. They were instructed how to hold the hoe, how to drive it deeply into the ground and how to pull

the hoe backwards toward themselves. Instruction was also given in how to place their feet and how to pull back with the hoe. This was successful. The tools used are pictured in Plate II.

Five of the subjects had cerebral palsy and severe brain damage. They were unable to use the special hoes. An analysis of their behavior indicated that they were unable to step backwards without falling. It was agreed that a trench was not needed. All that was needed was a series of holes large enough to accommodate the seed, of proper depth and of proper spacing of the crop planted. This led to the final set of tools, an earth puncher and a spacer. The same color coding as above was used. However, the spacer was at first a board with holes cut into it at the proper intervals. This was later modified to a piece of scrap canvas with a wooden spike at each end. This was spread over the ground and anchored at each end with the wooden spikes. The distances between the holes in the canvas varied, dependent upon the seed to be planted. For example, if seeds were to be planted two inches apart, the distance between the holes was two inches.

The earth puncher was constructed from a sawed-off broom handle with a tapered end. A round guard was placed with a set screw near the bottom end. If 2" was wanted for depth of hole, the guard was set so that when it struck the ground the end of the pole would be 2" into the ground. The same procedure was used for the other two depths. See Plate III for a picture of these tools.

Main Study

Because of the success of the second pilot study, the program was funded by a Federal Agency (CETA) the following year.

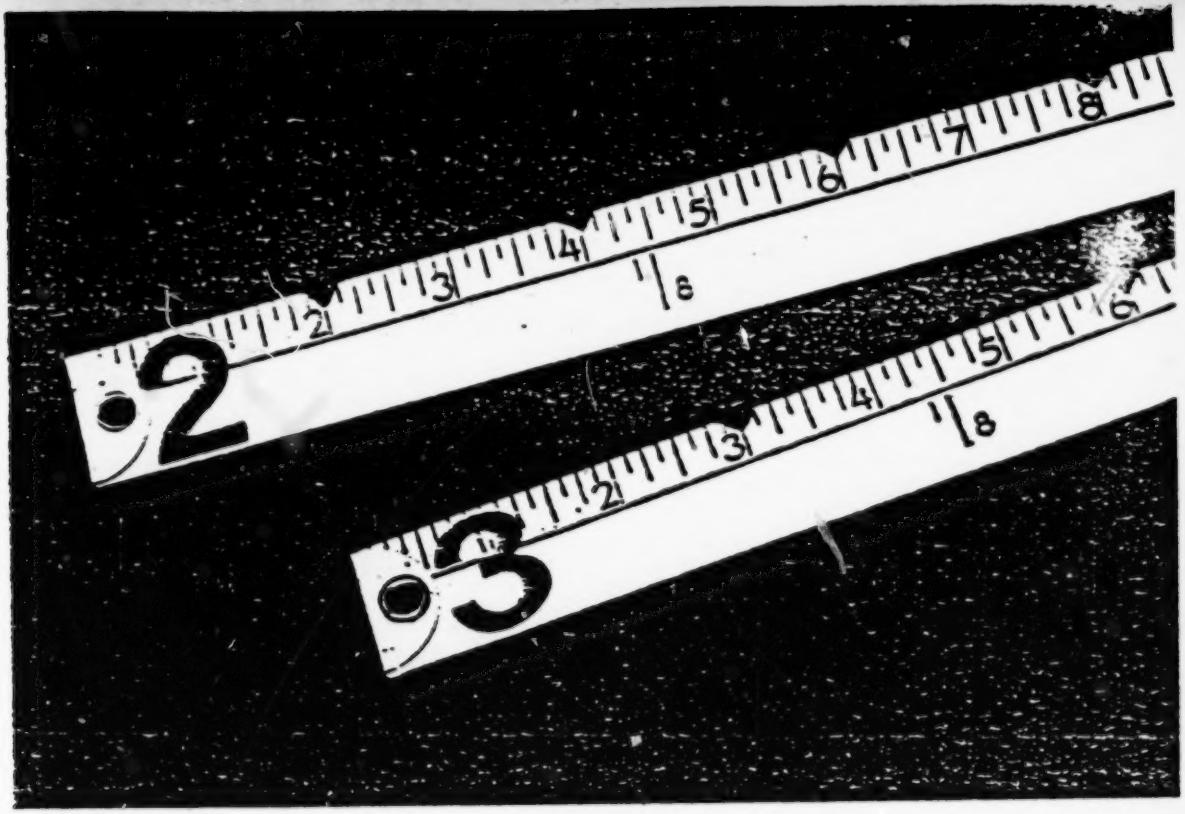

Plate I

Yardstick spacers used to space seeds in a trench.

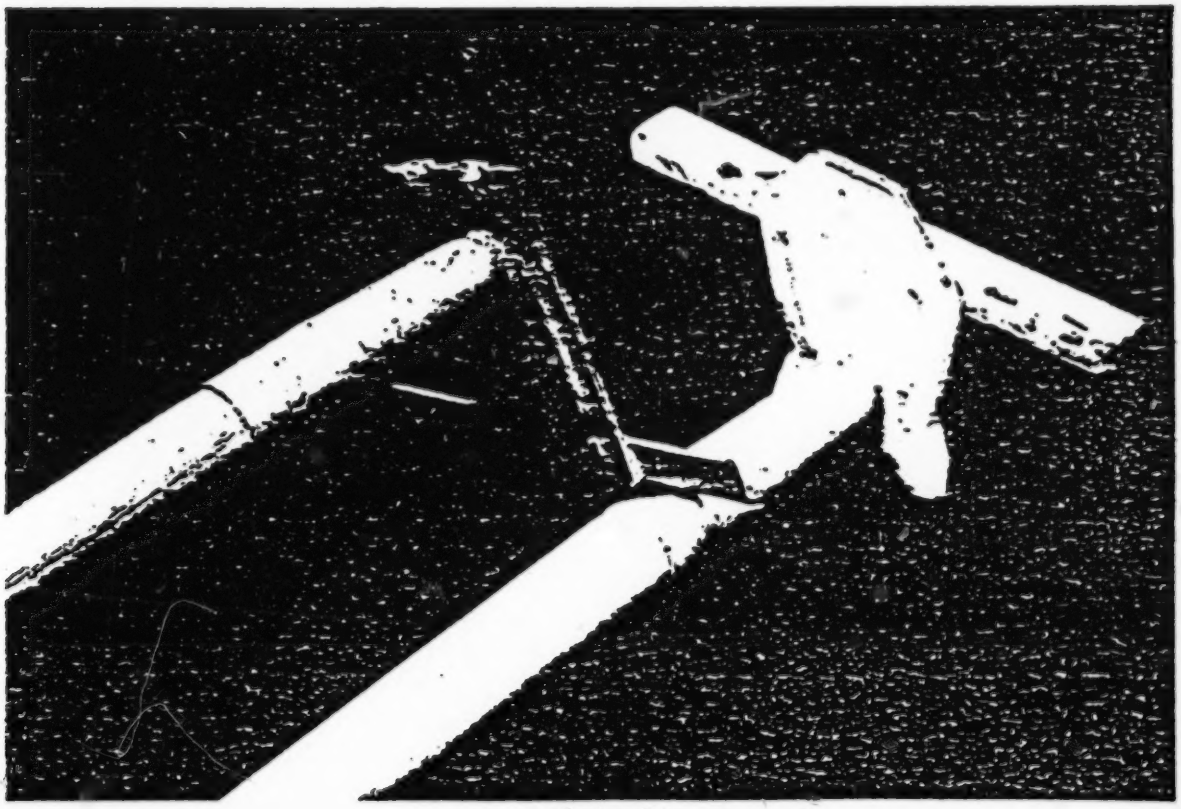

Plate II

Special modified hoes with color

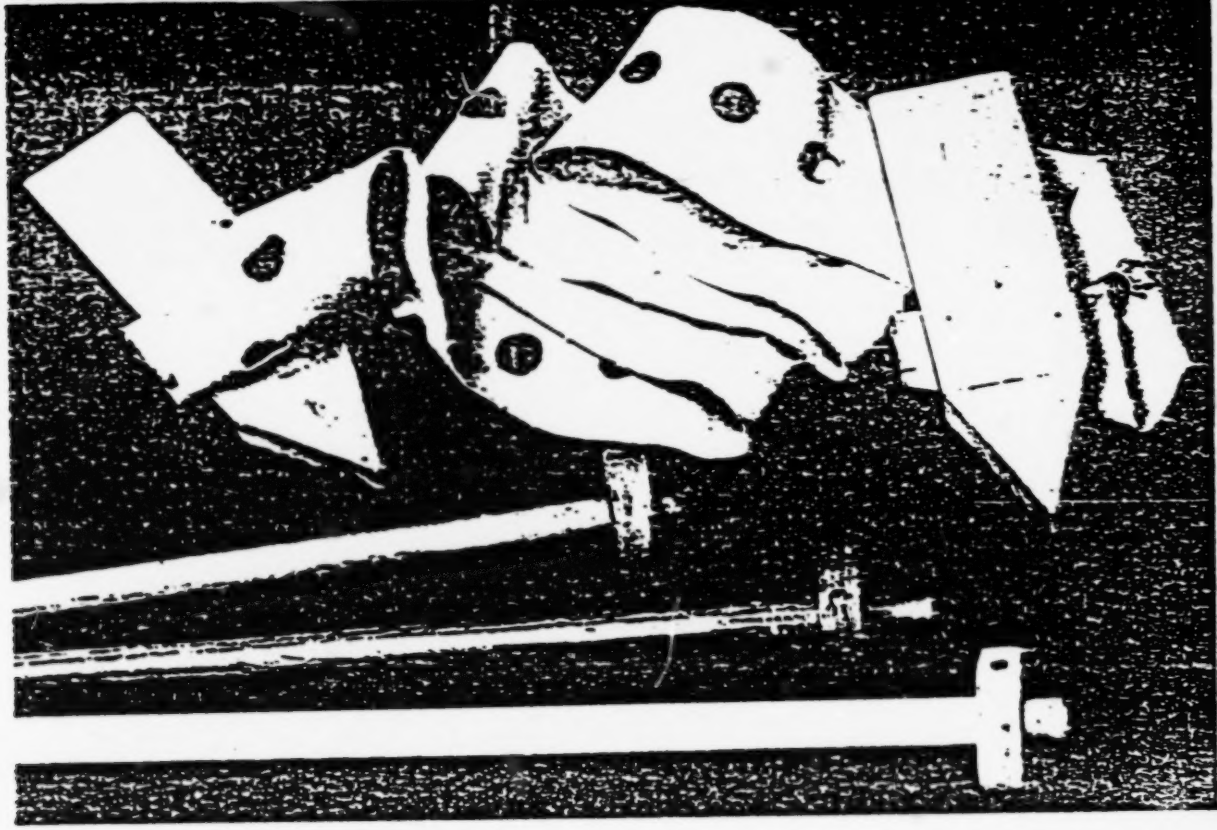

Plate III

Spacer and earth punchers

With the extra funding several changes were made.

1. Subjects were paid a small stipend.
2. Higher level subjects from the sheltered workshop were included.
3. Approximately one acre of good farm land was rented. The farm manager plowed the land and harrowed it in preparation for the program.
4. Higher level subjects from sheltered workshop were transported to and from the farm by van. Each subject worked one half day on the farm and returned to the workshop for the other half of the day.
5. A greenhouse operation was added to the program under the supervision of a trained and experienced person. Five separate job skills were identified in the greenhouse and five progress evaluation forms were added. Each subject was trained in these tasks and evaluated weekly to determine his or her progress (See Table III).
6. The subjects on the farm were higher level and did not require the use of the special tools.

When the weather became too cold for gardening, all subjects were moved into the greenhouse and worked there until the funding was expended. Two subjects were unable to tolerate the "closed in feeling" of the greenhouse and refused to continue. They were excused from the study and returned to the workshop.

All of the other subjects continued to learn and to be evaluated on the progress evaluation sheets.

During the pilot studies no funds were available to pay the subjects therefore the Wage and Hour Division of the Dept. insisted that each subject received all of the products he/she produced. It was necessary to have each client work in his/her own garden so it was certain that each subject received everything he/she produced.

In the main study, because all subjects were paid, it was not necessary to keep a record of what each subject grew therefore, all subjects worked in one large community garden (one acre) instead of each subject having his own individual garden. However, it became obvious that subjects showed more motivation and pride when they worked in their own garden that when working in a large community garden.

CURRICULUM

Task Rating Sheet

Evaluation Code.

The curriculum consists of 21 separate tasks performed in the garden and/or in the greenhouse. Each task was broken down into chronological steps, and, using the evaluation code, rated on the rating sheet. (See Table II)

Rating Scale

9 - No Help
8 - No help, but needs monitoring on task behavior
7 - Verbal/Nonverbal Prompting
6 - Verbal Direction
5 - Repeated Verbal Direction
4 - Following Demonstration
3 - Simultaneous Demonstration
2 - Physical Help with Cooperation
1 - Physical Help without Cooperation (resistant - flaccid)
0 - Not Attempted

Table II

Each task represented a job in the garden or greenhouse. (The tasks are presented on Table III.) The required task steps were evaluated by specially trained instructors who used the evaluation code shown on Table II.

The instructors verbally presented the task to each subject (such as use of modified hoe - making a trench) and rated their initial performance, thus establishing a baseline from which the subject's weekly improvement could be calculated.

An orientation garden was established in which each subject was required to master the basic skills of making a trench, planting seeds and covering seeds. Upon successful completion, they were presented with a cap and graduated into the main garden where they were assigned to their own garden plot.

Each subject was evaluated every week for a ten week period. The score received on the tenth week was considered to be the subjects final score. Gain scores could be calculated by subtracting the initial score from the final score. A score of 7 or more was considered satisfactory (verbal prompting), while scores of six or lower were considered unsatisfactory.

The process of priming and fading was utilized in which more and more help (priming) was used until the subject could do the task. The number relating to his initial success level is recorded as his initial or baseline rating. In subsequent sessions, the process of fading (removing help) was carried out and, as a result, higher scores were earned (See Table II). The rating registered on the subject's 10th week was considered to be his final rating. It was decided that any score of 7 or above (7,8, or 9) would indicate that the subject had

TABLE III

Tasks For Which Subjects Were Trained

A - Activities in Garden

B - Activities in Greenhouse

A + B - Activities in Garden and Greenhouse

1. (A+B) Following Directions
2. (A) Pulling Vegetation
3. (B) Mixing Soil and Peat Moss
4. (B) Pour Mixed Potting Soil into Seed Bed
5. (B) Preparing Potting Soil
6. (B) Smooth Potting Soil in Seed Bed
7. (B) Scooping Soil from Beds in Greenhouse
8. (A) Mechanical Operation of Wheelbarrow
9. (A) Walking Tiller
10. (A) Using Tiller
11. (A) Use of Modified Hoe - Making Trenches
12. (A) Use of Hoe in Chopping Vegetables
13. (A+B) Use of Trowel
14. (A) Making Trench in Seed Bed
15. (A) Planting Seeds with Spacer
16. (A+B) Planting Seeds Seed Bed
17. (A+B) Covering Seeds in Seed Bed
18. (A) Removing Palnts from Individual Packs
19. (A) Planting Tomato Plants
20. (A) Planting Green Pepper Plants
21. (A+B) Watering Plants with Sprinkling Can

satisfactorily mastered the task. Scores below 7 (6, 5, 4, 3, 2, 1, 0) would indicate that the subject failed to master the task.

RESULTS

Final ratings (scores) were averaged for each subject on each task.

The overall correlation between final ratings and I.Q. was calculated by Spearman Rank Correlation as shown below.

$$\text{Rho} = 1 - \frac{6\Sigma D^2}{n(n^2 - 1)}$$

$$= 1 - \frac{6(2083.5)}{31\,(31^2 - 1)}$$

$$= +.5799396$$

Rounded to +.58

The following pages show all of the final average scores for all subjects on all tasks. In each case, sex, age and I.Q. are presented. For each task with a final rating of 7 or above, an "S", meaning satisfactory was recorded. This means that this subject can perform this task at a level considered to be vocationally feasible.

For each task with a final rating of below 7 a "U", meaning unsatisfactory, was recorded. This indicated that this subject could not function on this task to a degree considered to be economically feasible. All subjects, including those whose I.Q.s were as low as 32, were able to function satisfactorily on several tasks. Not all subjects were able to attempt all tasks. Therefore, there is no score for some subjects on some tasks.

Table IV presents all subjects, including age, sex, I.Q., number of tasks attempted and number of tasks mastered yielding a

percentage of success trials.

Table V analyses each activity in regards to difficulty by determining the lowest I.Q. of subject which mastered the task. Task #8, Mechanical Operation of Wheelbarrow, appears to be the most difficult because no subject with an I.Q. below 50 mastered it.

A total of 17 tasks could be mastered by subjects with an I.Q. as low as 32, which represents the lowest I.Q. in the study.

Attempts were made to include subjects at much lower levels of intelligence, one as low as I.Q. 9, but no success was encountered when the I.Q. was below the thirties.

As previously reported (McCarron, Kern and Wold) (1979), the McCarron-Dial Work Evaluation System (MDWES) was administered to all subjects in the study and a correlation of $R = .90$, $p = .0001$) between the McCarron Dial and the post test measure was determined. It is interesting to note that the McCarron-Dial predicted scores after training, but did not correlate highly with initial baseline scores.

CONCLUSIONS

This study supports the hypothesis that mentally retarded subjects can be trained successfully in vocational horticulture through an on-the-job training approach and the modification of tools. It was found that subjects with I.Q.s as low as 32 could function on many of the tasks with minimum supervision. With further modification of the modified tools, subjects with severe brain injury could successfully work in the garden.

Color coding of special tools was found to be very effective.

TABLE IV

Client	Age	Sex	I.Q.	Number Tasks Tried	Number of Tasks Successfully Completed	Success %
1	32	M	49	14	7	50
2	21	M	61	8	8	100
3	25	M	32	13	10	77
4	22	F	53	14	12	86
5	28	F	46	15	7	47
6	29	F	34	14	2	14
7	48	M	51	10	10	100
8	22	M	52	9	9	100
9	29	F	54	12	11	92
10	22	F	59	8	8	100
11	27	F	49	15	15	100
12	23	F	34	7	7	100
13	29	M	32	11	10	91
14	27	M	56	11	10	91
15	42	F	73	17	16	94
16	31	F	59	17	17	100
17	46	M	89	8	8	100
18	43	M	83	11	11	100
19	25	M	60	8	8	100
20	30	F	62	16	16	100
21	21	M	50	15	15	100
22	41	M	50	15	15	100
23	49	M	68	16	16	100
24	26	M	49	14	13	93
25	38	M	63	12	12	100
26	34	F	34	8	5	62.5
27	24	M	75	8	8	100
28	28	M	64	16	16	100
29	20	M	75	12	11	92
30	23	M	43	12	11	92
31	28	M	48	13	3	23

TABLE V

TASKS LISTED ACCORDING TO DIFFICULTY SHOWING THE LOWEST I.Q. NECESSARY FOR MASTERING TASK.

Min. I.Q.	Job	Activities in Garden
43	1	Following Directions
32	2	Pulling Vegetation
50	8	Mechanical Operation of Wheelbarrow
32	9	Walking Tiller
32	10	Using Tiller
32	11	Use of Modified Hoe - Making Trenches
32	12	Use of Hoe in Chopping Vegetation
43	13	Use of Trowel
43	14	Making Trench in Seed Bed
32	15	Planting Seed with Spacer
43	16	Planting Seed in Seed Bed
43	17	Covering Seed in Seed Bed
32	18	Removing Plants from Individual Packs
32	19	Planting Tomato Plants
32	20	Planting Green Pepper Plants
32	21	Watering Plants with Sprinkling Can
		Activities in Greenhouse
32	1	Following Directions
32	3	Mixing Soil and Peat Moss
32	4	Pour Mixed Potting Soil into Seed Bed
32	5	Preparing Potting Soil
32	6	Smooth Potting Soil in Seed Bed
32	7	Scooping Soil from Beds in Greenhouse
43	13	Use of Trowel
43	16	Planting Seed in Seed Bed
43	17	Covering Seed in Seed Bed
32	21	Watering Plants with Sprinkling Can

An equally positive experience was obtained training the same subjects in a greenhouse. A total of twenty-one (21) tasks, including gardening tasks, greenhouse tasks and several tasks which applied both to greenhouse and garden, made up the curriculum.

A modest correlation between I.Q. and final rating of .58 was obtained in a Spearman Rank Order correlation.

It was found that having each subject work in his own individual garden was much more effective than having all subjects work cooperatively in one large garden. The pride shown by the subjects in showing the produce they grew in their own garden was tremendous.

Finally, with other studies showing the value of horticulture as a therapeutic technique, leisure time activity, or prevocational training tool and, now, with this study showing the value of horticulture in vocational training, it is strongly recommended that every agency which serves a mentally retarded population should have a garden and/or a greenhouse.

SUMMARY

This study consisted of three distinct parts.

1. The First Pilot Study carried out on land by the senior author and a horticulturist. Plans were made for the following summer with proposed methods of teaching mentally retarded subjects.
2. The Second Pilot Study was carried out by the three investigators using lower level subjects from an Adult Day Activities Center and a Work Activities Center. During this phase tools were modified. Color coding was introduced and, for brain

injured subjects, an "earth puncher" was used instead of a hoe. Both pilot studies were funded by the Fannie Blumberg Foundation.

3. The Main study utilized the same subjects from the Adult Day Activities Center and the Work Activities Center plus higher level subjects from the sheltered workshop. All subjects were paid for their services. During the winter a greenhouse project was added to the gardening program. The main study was funded by C.E.T.A..

A moderate correlation was found between quality of performance and I.Q.. The McCarron-Dial Work Evaluation System showed a very high validity in predicting the degree to which the subjects would learn the tasks.

A recommendation was made that all programs with mentally retarded clients should have a garden, preferably an individual garden, for each client.

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